

Long-Term Effects of 4 Popular Diets on Weight Loss and Cardiovascular Risk Factors

A Systematic Review of Randomized Controlled Trials

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Background—We conducted a systematic review to examine the efficacy of the Atkins, South Beach, Weight Watchers (WW), and Zone diets, with a particular focus on sustained weight loss at ≥ 12 months.

Methods and Results—We systematically searched MEDLINE, EMBASE, and the Cochrane Library of Clinical Trials to identify randomized controlled trials (RCTs) published in English with follow-up ≥ 4 weeks that examined the effects of these 4 popular diets on weight loss and cardiovascular risk factors. We identified 12 RCTs ($n=2559$) with follow-up ≥ 12 months: 10 versus usual care (5 Atkins, 4 WW, and 1 South Beach) and 2 head-to-head (1 of Atkins, WW, and Zone, and 1 of Atkins, Zone, and control). At 12 months, the 10 RCTs comparing popular diets to usual care revealed that only WW was consistently more efficacious at reducing weight (range of mean changes: -3.5 to -6.0 kg versus -0.8 to -5.4 kg; $P<0.05$ for 3/4 RCTs). However, the 2 head-to-head RCTs suggest that Atkins (range: -2.1 to -4.7 kg), WW (-3.0 kg), Zone (-1.6 to -3.2 kg), and control (-2.2 kg) all achieved modest long-term weight loss. Twenty-four-month data suggest that weight lost with Atkins or WW is partially regained over time.

Conclusions—Head-to-head RCTs, providing the most robust evidence available, demonstrated that Atkins, WW, and Zone achieved modest and similar long-term weight loss. Despite millions of dollars spent on popular commercial diets, data are conflicting and insufficient to identify one popular diet as being more beneficial than the others. (*Circ Cardiovasc Qual Outcomes*. 2014;7:00-00.)

Key Words: diet, carbohydrate-restricted ■ weight loss

A wide variety of diets are available to promote weight loss and improve cardiovascular risk factors, such as lipid levels, blood pressure, and glycemia. Among them, 4 are particularly popular among North Americans. Millions of copies of Atkins, South Beach (SB), and Zone instructional books have been sold,¹⁻³ and over a million Weight Watchers (WW) members attend its weekly group meetings globally.⁴ These diets contribute to a North American weight loss market estimated at $>\$66$ billion for 2013.⁵

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Each diet has its own philosophy and macronutrient targets. Atkins is a 4-phase diet based on very low carbohydrate intake, with unlimited protein and fat consumption.¹ SB is a 3-phase modified low-carbohydrate high-protein diet. It focuses on controlling carbohydrate intake, as well as eating

lean proteins, mono- or polyunsaturated fats, and low-glycemic index carbohydrates.² WW is a food, physical activity, and behavior modification plan that uses a personalized points system to provide caloric intake restriction and weekly group sessions led by plan graduates.⁶ Zone is a low-carbohydrate diet that recommends the consumption of low-fat proteins, low-glycemic load carbohydrates, and small amounts of good fat (eg, olive oil, avocado).³

The efficacy of these 4 popular commercial diets has been examined in several randomized controlled trials (RCTs), both comparing them to usual care and to each other. However, they provided heterogeneous results. Despite their popularity and their substantial contribution to a billion-dollar industry, the efficacy of these diets in promoting sustained weight loss and improving cardiovascular risk factors remains unclear. Our objective was to examine the efficacy of these 4 diets

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WHAT IS KNOWN

- The obesity epidemic and its accompanying health consequences in North America and worldwide are well-established.
- The efficacy of popular commercial diets at achieving sustained weight loss and improving cardiovascular risk factors remains unclear.

WHAT THE STUDY ADDS

- This systematic review demonstrates that available data on the efficacy of popular commercial diets are limited and heterogeneous, with 2 head-to-head trials suggesting that Atkins, Weight Watchers, and Zone achieve modest and similar long-term weight loss, as well as similar effects on cardiovascular risk factor levels.
- South Beach was only assessed in 1 long-term trial, which found no difference in weight loss versus usual care, and no data were reported on its effects on cardiovascular risk factor levels.
- Despite millions of dollars spent in the weight loss industry, available data are conflicting and insufficient to identify one popular diet as being more beneficial than the others.

in promoting weight loss and improving cardiovascular risk factors (ie, anthropometric measures, lipid profiles, blood pressure, and glycemia), with a particular focus on sustained weight loss at ≥ 12 months.

Methods

Search Strategy

We systematically searched the MEDLINE, EMBASE, and Cochrane Library of Clinical Trials databases from inception to May 2014 to

identify RCTs conducted in adults and published in English that examined the effect of Atkins, SB, Zone, or WW on weight loss and cardiovascular risk factors. These 4 diets were chosen as a representative and pragmatic sample of popular commercial diets: the first 3 are best-selling book-based diets,¹⁻³ whereas WW, another leading popular commercial diet, involves a contrasting meeting-based approach.⁴ Our search involved the following keywords: Atkins, calorie restriction, carbohydrate-restricted, diet, diet fads, diet therapy, fat-restricted, high-fiber, high-protein, low-carbohydrate, low-fat, popular diet, obese, Ornish, overweight, protein-restricted, SB, vegetarian diet, weight loss program, WW, and Zone. Although Ornish was initially included in our search, it is predominantly used and classified by US Medicare as Intensive Cardiac Rehabilitation.⁷ We thus excluded Ornish from the present study. Finally, we hand-searched references from published RCTs, relevant reviews, and previous meta-analyses for additional RCTs.

Inclusion Criteria

We included RCTs that examined the effects of Atkins, SB, WW, and Zone (diets described in Table I in the Data Supplement) on weight loss and cardiovascular risk factors with follow-up ≥ 4 weeks. A 4-week grace period was allowed for the classification of short- versus long-term RCTs (ie, <12 months versus ≥ 12 months) to account for RCTs that measured follow-up in weeks rather than months. We restricted inclusion to RCTs comparing these diets to usual care or to each other. To reduce heterogeneity and specifically examine these 4 popular diets, we also restricted inclusion to reports describing these diets by name or referencing specific manuals for those diets. For multiphase diets, included RCTs must have examined all phases preceding their final weight maintenance phase.

We excluded trials evaluating the effects of popular diets on weight maintenance, with participants with malignancies or post-transplant, without an appropriate active or usual care reference group, and those randomizing participants to an arm where they could preferentially select their diet, unless data from these participants were not combined with those of participants randomized directly to the studied diets.

Data Extraction and Analysis

Data on study characteristics, study population, demographic and clinical characteristics, intervention characteristics, and use of any

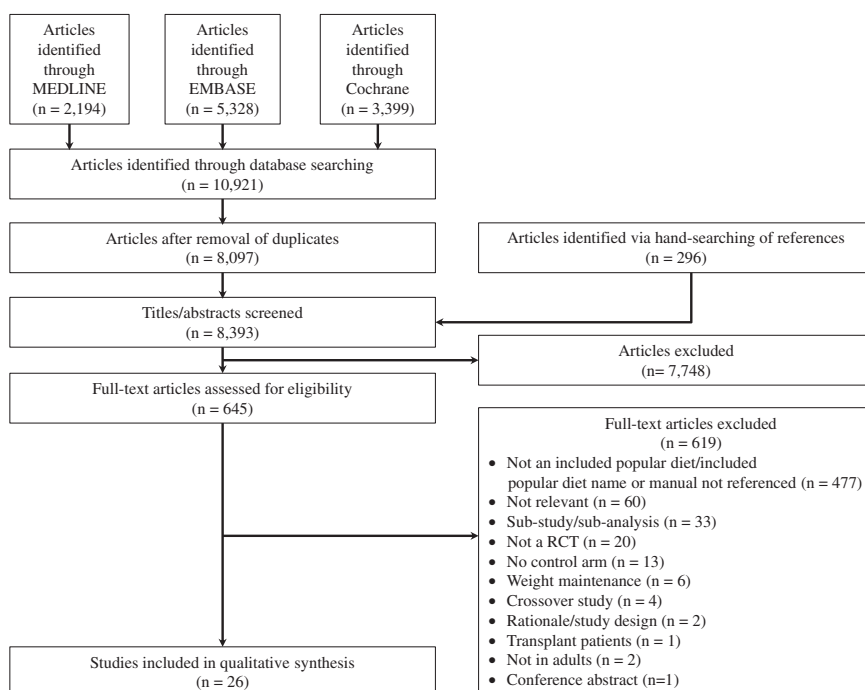


Figure 1. PRISMA flow diagram.

Table 1. Baseline Characteristics of Participants in Long-Term (≥ 12 mo) Trials

Study	Participants		Duration, wk	Population	Arms	Nutritional Counseling	Exercise Prescription	Age, y	Female, %	White, %	Weight, kg	BMI, kg/m ²
	Randomized	Analyzed										
Atkins												
Foster (2003) ¹¹	63	63*	52	Obese, otherwise healthy	Atkins	Yes	No	44.1	68.3	76.2	98.5	34.1
Davis (2009) ¹²	105	105†	52	BMI ≥ 25 , T2DM	Atkins	Yes	No	53.5	78.1	14.3	97.1	36.0
Goldstein (2011) ¹³	52	30§	52	BMI: 30–39.9, T2DM	Modified Atkins	Yes	No	56.0	51.9	NR	92.0	33.2
Shai (2008) ^{14¶}	213	213#	104	BMI ≥ 27 aged 40–65 y, or T2DM, or coronary heart disease	after 4-week Dietary Approach to Stop Hypertension run-in Atkins	Yes	No	51.5	11.7	NR	91.6	30.7
Foster (2010) ¹⁵	307	307**	104	BMI: 30–40, otherwise healthy	Atkins with comprehensive behavioral program††	Yes	Yes	45.5	67.8	70.7	103.4	36.1
South Beach												
Swenson (2007) ¹⁶	32‡‡	26§§	52	Severely obese postgastric bypass	South Beach	Yes	Yes	40.9‡‡	90.6‡‡	84.4‡‡	184.9‡‡	48.9‡‡
Weight Watchers												
Pinto (2013) ^{17¶¶}	97	95	48	BMI: 27–50 aged 30–65 y	WW	Yes for BWL intervention	Yes	49.1	89.5	NR	98.1	35.9
Jebb (2011) ¹⁸	772	772#	52	BMI: 27–35 with ≥ 1 other risk factor for obesity-related disease##	WW	Standard care at general practice	No	47.4	86.5	NR	86.7	31.4
Jolly (2011) ^{19¶¶***}	170	170†††	52	Overweight/obese \pm comorbidities‡‡‡	WW	Nurse-led individual support at general practice	No	50.6	70.0	88.2	92.9	33.6
Heshka (2003) ²⁰	423	423§§§	104	BMI: 27–40, \pm comorbidities	WW	Self-help	No	44.5	84.6	NR	93.6	33.7

(Continued)

Table 1. Continued

Study	Participants		Duration, wk	Population	Arms	Nutritional Counseling	Exercise Prescription	Age, y	Female, %	White, %	Weight, kg	BMI, kg/m ²
	Randomized	Analyzed										
Head-to-Head												
Dansinger (2005) ^{†¶¶}	120	120##	52	BMI: 27–42, with ≥1 cardiometabolic risk factor	Atkins WW Zone	Yes	No	49.0	53.3	73.3	98.7	34.7
Gardner (2007) ^{‡¶¶}	235	235##	52	BMI: 27–40, premenopausal, otherwise healthy	Atkins Zone LEARN†	Yes	No	40.7	100	72.3	85.0	31.3

ADA indicates American Diabetes Association; AHA, American Heart Association; BMI, body mass index; BWL, behavioral weight loss; CR, calorie restriction; LFD, low-fat diet; NR, not reported; T2DM, type 2 diabetes mellitus; and WW, Weight Watchers.

*Repeated-measures analysis of variance (ANOVA) with baseline observation carried forward (BOCF).

†The LEARN Program for Weight Management manual contains 16 lessons addressing different aspects of weight management.

‡Intention-to-treat (ITT) analysis with hierarchical linear models to analyze all available data.

§Repeated-measures ANOVA ignoring dropouts.

||Very low carbohydrate content of 25 g/d for the first 6 wk postrandomization increased to 40 g/d thereafter, with unrestricted calorie, protein, or fat intake and encouraging participants to increase their fat consumption through foods rich in monounsaturated fatty acids.

¶Trial had other arms that were not included.

#ITT analysis with last observation carried forward (LOCF).

**Random-effects linear model fitted to all available data for each variable for all 307 participants.

††Delivered in-person to participants through group sessions held throughout the study follow-up, and comprising topics on behavioral skills (eg, self-monitoring, stimulus control, relapse management); an exercise prescription; and daily multivitamin supplements.

‡‡Modified ITT analysis including 32 patients who completed ≥1 postoperative assessment (baseline assessment completed by n=43).

§§Completers analysis.

|||Linear mixed models including all participants and using all available data.

¶¶Emphasizing behavioral skills and comprising closed-group meetings led by BWL expert; moderate CR dietary intervention with ≤25% fat; and an exercise prescription.

#Central adiposity, T2DM not insulin-treated, family history of diabetes mellitus, previous gestational diabetes mellitus, impaired glucose tolerance or fasting glycemia, mild-to-moderate dyslipidemia, hypertension treatment, polycystic ovarian syndrome or infertility with no other apparent cause than weight, lower-limb osteoarthritis, and abdominal hernia.

***Twelve-week dietary intervention.

††ITT analysis with BOCF.

‡‡‡Trial eligibility: South Asians without comorbidity BMI ≥25, with comorbidity, BMI ≥23; white Europeans/all other ethnic groups without comorbidities BMI ≥30, with comorbidities, BMI ≥28.

§§§ITT analysis with LOCF or linear interpolation and BOCF for participants with no follow-up data

|||Fasting glucose ≥6.1 mmol/L, total cholesterol ≥5.2 mmol/L, low-density lipoprotein cholesterol ≥3.4 mmol/L, high-density lipoprotein cholesterol ≤1.0 mmol/L, triglycerides ≥1.7 mmol/L, systolic blood pressure ≥145 mm Hg, diastolic blood pressure ≥90 mm Hg, or current use of medication for hypertension, diabetes mellitus, or dyslipidemia.

cointerventions (eg, exercise, nutritional counseling) were independently extracted by 2 reviewers using a standardized form, with disagreements resolved by consensus or by a third reviewer. Nutritional counseling was defined as any additional, clearly specified one-on-one or group meeting with registered dietitians, nutritionists, or other healthcare professionals or research staff, with training or experience in obesity management. Outcome data were extracted for the longest follow-up time available; for studies with 24-month follow-up, 12-month data were also extracted. In studies where authors used multiple statistical methods, we extracted the results of their primary analysis. Our primary end point was sustained weight loss, defined as mean weight change at ≥ 12 months, reported in kg or as mean percentage change. Secondary end points included mean change and mean percentage change in body mass index, body fat, waist circumference, waist-to-hip ratio, fasting glucose, fasting insulin, total cholesterol, low-density lipoprotein cholesterol, high-density lipoprotein cholesterol, triglycerides, systolic blood pressure (SBP), diastolic blood pressure (DBP), and the prevalence of adverse events. Close examination of extracted data revealed significant clinical heterogeneity; quantitative meta-analyses were, therefore, not undertaken.^{8,9} Finally, RCT quality was assessed using the Cochrane Collaboration's tool for assessing risk of bias¹⁰ independently by 2 reviewers, with disagreements resolved by consensus or by a third reviewer.

Results

Search Results

Our search yielded 8393 potentially relevant publications (Figure 1). After screening titles and abstracts, 645 were retrieved for full-text review. Of those, 26 RCTs met our inclusion criteria.

Study Characteristics

Of the 26 included RCTs, 14 (n=1016) had short-term follow-up (<12 months) (Table II in the Data Supplement) and 12 (n=2559) had long-term follow-up (≥ 12 months)^{11–22} (Table 1). Ten long-term RCTs were versus usual care (5 Atkins, 4 WW, and 1 SB), and 2 were head-to-head (1 of Atkins, WW, and Zone; 1 of Atkins, Zone, and control; Table 1). There was significant heterogeneity in study populations, control interventions, as well as specific components and delivery of the popular diets, which prevented quantitative synthesis. Finally, most of the 26 included RCTs had an unclear risk of bias in

the domains of allocation concealment, blinding, and incomplete data reporting. Six and 5 RCTs, respectively, had high risks of bias in the latter 2 domains (Figure 2), largely because of their poor or incomplete outcome collection and high rate of loss to follow-up.

Participant Characteristics

The majority of the 26 included RCTs assessed the effects of popular diets in otherwise healthy overweight or obese individuals, whose mean age ranged from 35.5 to 56.0 years (median: 45.0 years; Table II in the Data Supplement ; Table 1). Mean weight of participants ranged from 65.9 to 184.9 kg (median: 92.5 kg), with 1 RCT conducted in Chinese women²³ and another evaluating the efficacy of SB in severely obese subjects postgastric bypass surgery.¹⁶ Dropouts $\geq 20\%$ were reported in 13 included RCTs. Finally, the majority of studies were conducted in young, white, obese women, with few data available on their use in men and in individuals whose body mass index <30 kg/m² (Table II in the Data Supplement; Table 1).

Weight Loss and Change in Other Anthropometric Measures

Short-term RCTs revealed generally greater weight loss and improvements in other anthropometric measures with popular diets, with some heterogeneity on Zone.^{24,25} Findings from the 2 head-to-head RCTs suggest that Atkins, WW, and Zone achieved similar short-term weight loss and improvements in other anthropometric measures^{25,26} (Table III in the Data Supplement).

There was also heterogeneous reporting of changes in weight and other anthropometric measures in long-term RCTs (Table 2). At 12 months, the 10 RCTs comparing popular diets to usual care showed that only WW was consistently more efficacious at reducing weight (range of mean changes: -3.5 to -6.0 kg versus -0.8 to -5.4 kg; $P < 0.05$ for 3/4 RCTs; Table 2; Figure 3). This reduction was accompanied by statistically significant improvements in other anthropometric measures in the 3 WW RCTs reporting these outcomes. Atkins' efficacy was inconsistent at 12 and 24 months, whereas the single SB RCT¹⁶ found no difference versus usual care among severely obese patients postgastric

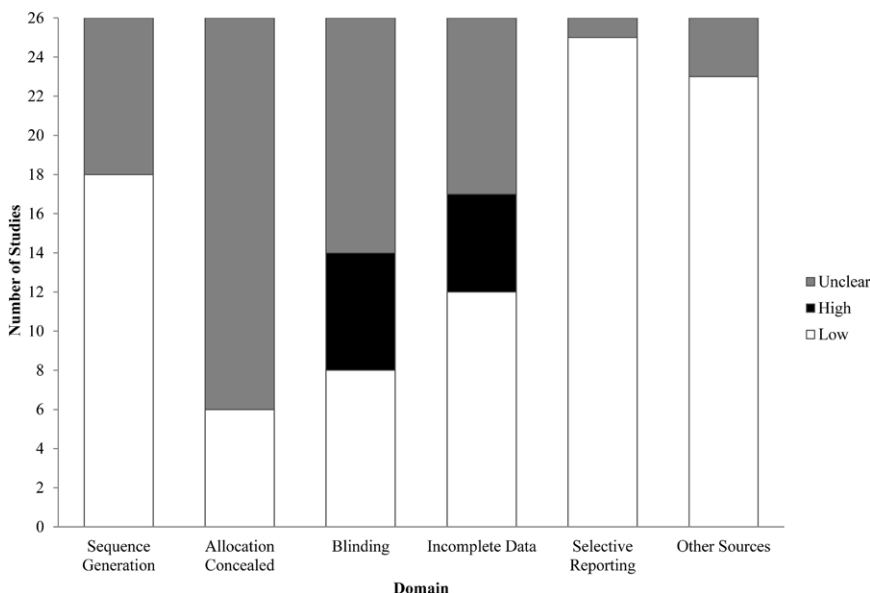


Figure 2. Risk of bias of included trials as per the Cochrane Risk of Bias Tool.

Table 2. Change in Body Weight and Other Anthropometric Measures in Long-Term (≥ 12 mo) Trials*

Study	Follow-Up, mo	Weight		Body Mass Index			Waist Circumference		Body Fat		
		Baseline, kg	Mean Change, kg	% Change	Baseline, kg/m ²	Mean Change, kg/m ²	% Change	Baseline, cm	Mean Change, cm	Baseline, kg or %	Mean Change, kg or %
Atkins											
Foster (2003) ¹¹											
Control	12	98.3±16.4	NR	-2.5±6.3	34.4±3.1	NR	NR	NR	NR	NR	NR
Intervention		98.7±19.5		-4.4±6.7	33.9±3.8						
Davis (2009) ¹²											
Control	12	101±19	-3.1±5.8	NR	37±6	NR	NR	NR	NR	NR	NR
Intervention		93.6±18	-3.1±4.8		35±6						
Goldstein (2011) ¹³											
Control	12	92.2±13.7	-5.4±5.7	NR	33.3±3.0	NR	NR	113±10	NR	NR	NR
Intervention		91.7±10.2	-3.4±4.0		33.1±3.6			112±8			
Shai (2008) ^{14†}											
Control	12	91.3±12.3	NR	NR	30.6±3.2	NR	NR	105.3±9.2	NR	NR	NR
Intervention		91.8±14.3			30.8±3.5			106.3±9.1			
Control	24	91.3±12.3	-2.9±4.2		30.6±3.2	-1.0±1.4	NR	105.3±9.2	-2.8±4.3		
Intervention		91.8±14.3	-4.7±6.5‡		30.8±3.5	-1.5±2.1		106.3±9.1	-3.8±5.2		
Foster (2010) ¹⁵											
Control	12	103.5±14.4	-10.81 (-12.4, -9.28)		36.1±3.46		NR	NR	NR	40.4±7.8 kg	-7.29 kg (-8.55, -6.03)
Intervention		103.3±15.5	-10.87 (-12.1, -9.67)	NR	36.1±3.59		NR	NR	NR	40±7.6 kg	-7.83 kg (-7.89, -6.14)
Control	24	103.5±14.4	-7.4 (-9.1, -5.63)		36.1±3.46		NR	NR	NR	40.4±7.8 kg	-3.84 kg (-5.03, -2.64)
Intervention		103.3±15.5	-6.3 (-8.06, -4.63)		36.1±3.59					40±7.6 kg	-3.99 kg (-5.50, -2.79)
South Beach											
Swenson (2007) ¹⁶											
Control	12	166.5±71	NR	-60.3±15.3§	46.3±9.4	NR	-14.0±5.5	140±25	NR	58.4±14 kg	NR
Intervention		197.5±85		-59.6±13.0§	50.7±8.7		-17.0±4.5	145±16		70.5±21 kg	
Weight Watchers											
Pinto (2013) ¹⁷											
Control	12	97.3±17.1	-5.4 (SE: 0.8)	NR	36.4±5.0	NR	NR	NR	NR	NR	NR
Intervention		98.9±19.1	-6.0 (SE: 0.8)		35.5±5.3						
Jebb (2011) ¹⁸											
Control	12	86.5±11.5	-2.25 (SE: 0.21)	NR	31.3±2.6	NR	NR	99.9±9.3	-3.16 (SE: 0.28)	32.9±7.4 kg	-1.85 (SE: 0.19) kg
Intervention		86.9±11.6	-5.06 (SE: 0.31)‡		31.5±2.6			100±9.2	-5.6 (SE: 0.37)‡	33.3±7.0 kg	-4.23 (SE: 0.28) kg†

(Continued)

(Continued)

Table 2. Continued

Study	Follow-Up, mo	Weight		% Change	Body Mass Index		Waist Circumference		Body Fat	
		Baseline, kg	Mean Change, kg		Baseline, kg/m ²	Mean Change, kg/m ²	Baseline, cm	Mean Change, cm	Baseline, kg or %	Mean Change, kg or %
Jolly (2011) ^{19†}	12	92.04±14.75	-0.8 (-2.0, 0.4)	NR	33.06±3.5	-0.32 (-0.7, 0.1)	NR	NR	NR	NR
Intervention		93.47±14.15	-3.5 (-4.8, -2.1)		33.96±3.9	-1.17 (-1.7, -0.7)				
Heshka (2003) ²⁰	12	93.1±14.4	-1.3 (SE: 0.4)		33.6±3.7	-0.5 (SE: 0.2)		99±12	-1.6 (SE: 0.6)	45±9%
Control		94.2±13.1	-4.3 (SE: 0.4)‡	NR	33.8±3.4	-1.6 (SE: 0.2)‡	NR	101±12	-4.1 (SE: 0.6)‡	44±8%
Intervention	24	93.1±14.4	-0.2 (SE: 0.4)		33.6±3.7	-0.2 (SE: 0.2)		99±12	-0.6 (SE: 0.6)	45±9%
Control		94.2±13.1	-2.9 (SE: 0.5)‡		33.8±3.4	-1.1 (SE: 0.2)‡		101±12	-2.4 (SE: 0.6)‡	44±8%
Intervention										
Head-to-Head										
Dansinger (2005) ^{21†}										
Atkins		100±14	-2.1±4.8		35±3.5	-0.7±1.6		109±11	-2.5±4.5	
Weight Watchers	12	97±14	-3.0±4.9	NR	35±3.8	-1.1±1.7	NR	108±11	-3.3±5.4	NR
Zone		99±18	-3.2±6.0		34±4.5	-1.1±2.0		108±13	-2.9±5.3	
Gardner (2007) ^{22†}										
Control		85±14	-2.2 (-3.6, -0.8)		31±4	-0.9±2.0		NR	NR	38±6%
Atkins	12	86±13	-4.7 (-6.3, -3.1)	NR	32±4	-1.7±2.5	NR			41±6%
Zone		84±12	-1.6 (-2.8, -0.4)		31±3	-0.5±2.0				40±6%

All values are mean±SD or mean (95% CI) unless otherwise indicated. NR indicates not reported; and SE, standard error.

* Only long-term follow-up data from these studies are presented in this table.

† Trial had other arms that were not included.

‡ P<0.05 for difference between groups.

§ Loss of excess body weight.

¶ P<0.05 for difference between groups; calculated using data presented in the original article.

¶ P<0.05 vs. Zone.



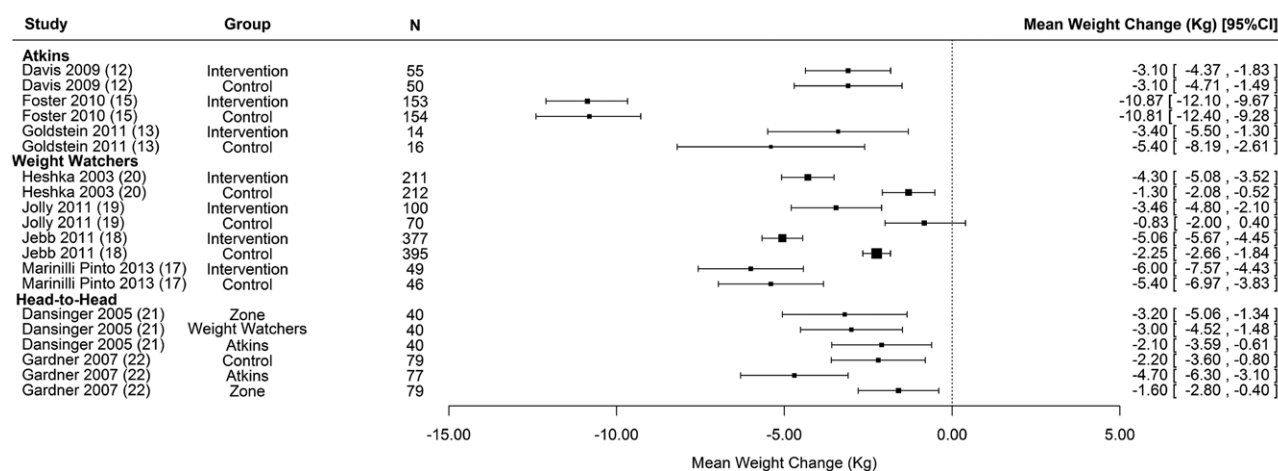


Figure 3. Forest plot for mean weight change from baseline to 12 months among long-term trials. N is the number of patients included in the 12-month analysis. CI indicates confidence interval.

bypass surgery (Table 2; Figure 3). Head-to-head comparisons of Atkins, WW, and Zone, as well as of Atkins, Zone, and control, suggest that at 12 months, Atkins (range: -2.1 to -4.7 kg), WW (-3.0 kg), Zone (-1.6 to -3.2 kg), and control (-2.2 kg) all achieved modest weight loss.^{21,22} The only statistically significant comparisons from these head-to-head RCTs were reported by Gardner et al²² for Atkins versus Zone for weight loss and body mass index (Table 2; Figure 3). Overall, much of the weight loss achieved early in follow-up (eg, <6 months) was regained over time such that these diets were generally similar in efficacy relative to control by 12 months (data not shown). This trend was particularly prominent with the Atkins diet. Similarly, 24-month data suggest that the weight lost with Atkins or WW at 12 months is partially regained over time (Table 2).

Lipid Levels

Of the 14 short-term RCTs, 3 examined the effect of SB, WW, and Zone on lipid profiles. Eight RCTs provided data on Atkins and suggest a favorable impact on high-density lipoprotein cholesterol and triglycerides relative to usual care, WW, and Zone. However, Atkins may have an adverse effect on low-density lipoprotein cholesterol levels, with unchanged or increased levels observed in 5 RCTs (Table IV in the Data Supplement). Long-term RCTs comparing Atkins to usual care showed significant improvements in high-density lipoprotein cholesterol and, to a lesser extent, triglyceride levels at 12 and 24 months; there was no evidence of a low-density lipoprotein cholesterol increase (Table 3). There were no or limited data on the effect of SB and WW on lipid profiles versus usual care at ≥ 12 months. Finally, results from the 2 long-term head-to-head RCTs found no marked differences between the Atkins, WW, and Zone diets in improving lipid levels at 12 months, with only a significant improvement in triglyceride levels for Atkins versus Zone reported by Gardner et al²² (Table 3).

Blood Pressure

Findings from short-term RCTs showed that Atkins and WW had favorable effects on SBP and DBP, with benefits being greatest with the Atkins diet. No blood pressure data were available regarding SB, and only 1 RCT provided such data regarding Zone (Table V in the Data Supplement). Atkins and

WW had inconsistent long-term effects on SBP and DBP versus usual care, with only a significant improvement in DBP at 12 months with WW reported by Heshka et al²⁰ and at 24 months with Atkins reported by Foster et al.¹⁵ There were no blood pressure data for SB (Table 4). Findings from the 2 head-to-head RCTs indicated that Zone was less effective than Atkins and WW and similar to usual care at improving SBP and DBP, even increasing SBP in 1 RCT. There were no statistically significant comparisons in these 2 trials, with the exception of Atkins being more effective than Zone and control at improving SBP in the study by Gardner et al²² (Table 4).

Glycemic Control Measures

Overall, there were no major differences in glycemic control measures between popular diets in short-term RCTs. Atkins showed a trend toward worsened fasting glucose, but improved fasting insulin. There was limited evidence available on WW and Zone (1 RCT each) (Table VI in the Data Supplement). Limited long-term evidence was also available on the impact of popular diets on glycemic control measures versus usual care (Atkins: 1 RCT; WW: 2 RCTs) (Table VII in the Data Supplement). Findings from head-to-head RCTs suggest that Atkins, WW, Zone, and control were similar at improving fasting glucose and insulin at 12 months, with no statistically significant difference between groups (Table VII in the Data Supplement).

Discussion

Our systematic review was designed to examine the currently available evidence on the efficacy of the Atkins, SB, WW, and Zone diets at promoting weight loss and improving cardiovascular risk factors, with a particular focus on sustained weight loss at ≥ 12 months. We found a small number of heterogeneous RCTs. Although this heterogeneity prevented quantitative synthesis of our findings,^{8,9} qualitative synthesis of this limited body of evidence was nevertheless informative.

Our results suggest that all 4 diets are modestly efficacious for short-term weight loss, but that these benefits are not sustained long-term. Long-term RCTs comparing popular diets to usual care suggested that WW might be more efficacious than Atkins and SB at 12 months, as it was the only diet achieving consistent weight loss across trials. These findings were

Table 3. Change in Lipid Levels in Long-Term (≥ 12 mo) Trials*

Study	Follow-Up, mo	Total Cholesterol			Low-Density Lipoprotein Cholesterol			High-Density Lipoprotein Cholesterol			Triglycerides		
		Baseline, mmol/L	Mean Change, mmol/L	% Change	Baseline, mmol/L	Mean Change, mmol/L	% Change	Baseline, mmol/L	Mean Change, mmol/L	% Change	Baseline, mmol/L	Mean Change, mmol/L	% Change
Atkins													
Foster (2003) ¹¹													
Control	12	5±0.8	NR	-0.075±0.21			-0.08±0.31	1.3±0.3	NR	0.041±0.29	1.4±0.9	NR	0.008±0.04
Intervention		5.2±0.9		0.003±0.25			0.008±0.43	1.2±0.3		0.28±0.50†	1.5±1.3		-0.19±0.26†
Davis (2009) ¹²													
Control	12	4.3±0.9	-0.1±0.7	NR		2.4±0.7	NR	1.2±0.3	0.1±0.2	NR	1.4±0.7	0.0±0.9	NR
Intervention		4.4±0.8	0.1±0.8			2.5±0.7		1.3±0.2	0.2±0.3†		1.4±0.8	-0.2±0.9	
Goldstein (2011) ¹³													
Control	12	5.17±0.96	-0.05±0.54	NR		NR	NR	1.1±0.3	0.14±0.23	NR	2.21±0.97	-0.045±0.62	NR
Intervention		5.02±0.65	-0.2±0.7					1.14±0.34	0.11±0.2		2.31±1.12	-0.45±0.76	
Shai (2008) ^{14†}													
Control	12	NR	NR	NR		3.0±0.9	NR	1±0.3	NR	NR	1.8±0.7	NR	NR
Intervention						3.0±0.9		1±0.2			2.1±1.3		
Control	24					3.0±0.9	-0.001	1±0.3	0.17		1.8±0.7	-0.032	
Intervention						3.0±0.9	-0.078	1±0.2	0.22†		2.1±1.3	-0.27†	
Foster (2010) ¹⁵													
Control		5.0±0.9				3.2±0.8	-0.22 (-0.33, -0.12)	1.2±0.3	0.10 (0.065, 0.14)		1.4±0.8	-0.36 (-0.45, -0.27)	
Intervention	12	4.9±0.8	NR	NR		3.1±0.7	-0.22 (-0.33, -0.11)	1.2±0.4	0.21 (0.16, 0.25)†	NR	1.3±0.6	-0.20 (-0.32, -0.09)†	NR
Control	24	5.0±0.9				3.2±0.8	-0.21 (-0.3, -0.12)	1.2±0.3	0.12 (0.07, 0.14)		1.4±0.8	-0.16 (-0.29, -0.04)	
Intervention		4.9±0.8				3.1±0.7	-0.12 (-0.24, -0.01)	1.2±0.4	0.2 (0.16, 0.25)†		1.3±0.6	-0.14 (-0.26, -0.02)	
South Beach													
Swenson (2007) ¹⁶													
Control	12	NR	NR	NR		NR	NR	NR	NR	NR	NR	NR	NR
Intervention													
Weight Watchers													
Pinto (2013) ¹⁷													
Control	12	NR	NR	NR		NR	NR	NR	NR	NR	NR	NR	NR
Intervention													
Jebb (2011) ¹⁸													
Control	12	NR	0.03 (SE: 0.03)	NR		NR	0.02 (SE: 0.03)	NR	0.04 (SE: 0.01)	NR	NR	-0.06 (SE: 0.03)	NR
Intervention			0.00 (SE: 0.04)				-0.01 (SE: 0.03)		0.06 (SE: 0.01)			-0.09 (SE: 0.03)	

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Table 3. Continued

Study	Follow-Up, mo	Total Cholesterol			Low-Density Lipoprotein Cholesterol			High-Density Lipoprotein Cholesterol			Triglycerides		
		Baseline, mmol/L	Mean Change, mmol/L	% Change	Baseline, mmol/L	Mean Change, mmol/L	% Change	Baseline, mmol/L	Mean Change, mmol/L	% Change	Baseline, mmol/L	Mean Change, mmol/L	% Change
Jolly (2011) ^{19,†}	12	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Control													
Intervention													
Heshka (2003) ²⁰	12	5.4±0.92	-0.25 (SE: 0.04)										
Control													
Intervention		5.54±0.98	-0.23 (SE: 0.04)	NR	NR	NR	NR	1.26±0.33	0.021 (SE: 0.02)	1.59±0.93	0.017 (SE: 0.043)		
Control	24	5.4±0.92	-0.3 (SE: 0.05)					1.29±0.31	0.052 (SE: 0.02)	1.75±1.12	-0.088 (SE: 0.042)		NR
Intervention		5.54±0.98	-0.3 (SE: 0.05)					1.26±0.33	0.0 (SE: 0.02)	1.59±0.93	-0.0 (SE: 0.04)		
Head-to-Head								1.29±0.31	0.0 (SE: 0.02)	1.75±1.12	-0.0 (SE: 0.05)		
Dansinger (2005) ^{21,††}													
Atkins		5.53±0.8	-0.1±0.6		3.52±0.8	-0.2±0.6		1.24±0.41	0.1±0.2	1.72±1.12	0.0±0.9		
Weight Watchers	12	5.72±1.19	-0.2±0.6	NR	3.67±1	-0.2±0.7	NR	1.22±0.06	0.1±0.3	1.74±0.98	-0.1±0.7		NR
Zone		5.74±1.19	-0.3±0.9		3.57±1.16	-0.3±0.9		1.24±0.34	0.1±0.3	2.19±1.39	0.0±1.7		
Gardner (2007) ^{22,‡}													
Control					2.69±0.75	0.0±0.4		1.31±0.28	0.1±0.2	1.34±0.82	-0.2±0.7		
Atkins	12	NR	NR	NR	2.82±0.75	0.0±0.6	NR	1.37±0.36	0.1±0.2	1.4±0.88	-0.3±0.7§		NR
Zone					2.95±0.83	0.0±0.5		1.34±0.28	0.1±0.2	1.39±1.11	0.0±0.5		

All values are mean±SD or mean (95% CI) unless otherwise indicated. NR indicates not reported; and SE, standard error.

*Only long-term follow-up data from these studies are presented in this table.

†P<0.05 for difference between groups.

‡Trial had other arms that were not included.

§P<0.05 vs. Zone.



Table 4. Change in Blood Pressure in Long-Term (≥ 12 mo) Trials*

Study	Follow-Up, mo	Systolic Blood Pressure			Diastolic Blood Pressure		
		Baseline, mm Hg	Mean Change, mm Hg	% Change	Baseline, mm Hg	Mean Change, mm Hg	% Change
Atkins							
Foster (2003) ¹¹							
Control	12	123.3±14.1	NR	1.7±11.8	77.6±10.8	NR	-3.8±13.2
Intervention		120.5±11.0		-1.0±9.4	74.6±8.5		-3.7±12.4
Davis (2009) ¹²							
Control	12	130±17	-1.8±22.6	NR	77±10	-2.2±11.6	NR
Intervention		125±18	2.0±15.6		73±9	-2.9±9.4	
Goldstein (2011) ¹³							
Control	12	136±14	-5±12	NR	80±9	-3.8±7	NR
Intervention		140±17	-14±38		79±10	-8.3±19	
Shai (2008) ^{14†}							
Control	12	129.6±13.2	NR		79.1±9.1	NR	
Intervention		130.8±15.1		NR	79.4±9.1		NR
Control	24	129.6±13.2	-4.3±11.8		79.1±9.1	-0.9±8.1	
Intervention		130.8±15.1	-3.9±12.8		79.4±9.1	-0.8±8.7	
Foster (2010) ¹⁵							
Control	12	124.6±15.8	-4.06 (-6.07, -2.05)		76±9.7	-2.19 (-3.58, -0.79)	
Intervention		124.3±14.1	-5.64 (-7.62, -3.67)	NR	73.9±9.4	-3.25 (-4.74, -1.76)	NR
Control	24	124.6±15.8	-2.6 (-5.07, -0.12)		76±9.7	-0.5 (-2.13, 1.13)	
Intervention		124.3±14.1	-2.7 (-5.08, -0.27)		73.9±9.4	-3.2 (-4.66, -1.73)‡	
South Beach							
Swenson (2007) ¹⁶							
Control	12	NR	NR	NR	NR	NR	NR
Intervention							
Weight Watchers							
Pinto (2013) ¹⁷							
Control	12	NR	NR	NR	NR	NR	NR
Intervention							
Jebb (2011) ¹⁸							
Control	12	124.2±14.7	-1.50 (SE: 0.64)	NR	79.1±9.0	-1.29 (SE: 0.41)	NR
Intervention		124.7±17.1	-2.37 (SE: 0.67)		78.2±9.8	-1.61 (SE: 0.44)	
Jolly (2011) ^{19†}							
Control	12	NR	NR	NR	NR	NR	NR
Intervention							
Heshka (2003) ²⁰							
Control	12	121±12	0.2 (SE: 0.8)		79±9	1.4 (SE: 0.6)	
Intervention		123±14	-0.6 (SE: 0.9)	NR	79±8	-0.4 (SE: 0.6)‡	NR
Control	24	121±12	-2.4 (SE: 1.0)		79±9	0.0 (SE: 0.6)	
Intervention		123±14	-2.2 (SE: 1.1)		79±8	-0.6 (SE: 0.7)	
Head-to-Head							
Dansinger (2005) ^{21†}							
Atkins	12	129±17	0.2±12		77±9	-1.4±7.5	
Weight Watchers		133±17	-2.7±13.0	NR	74±11	-1.7±6.4	NR
Zone		130±16	1.4±15.0		77±10	-1.2±9.5	
Gardner (2007) ^{22†}							
Control	12	116±12	-3.1±9.3		75±9	-2.2±6.7	
Atkins		118±11	-7.6±11.0§	NR	75±8	-4.4±8.4	NR
Zone		115±13	-3.3±8.1		74±9	-2.1±5.8	

All values are mean \pm SD or mean (95% CI) unless otherwise indicated. NR indicates not reported; and SE, standard error.

*Only long-term follow-up data from these studies are presented in this table.

†Trial had other arms that were not included.

‡ $P < 0.05$ for difference between groups.

§ $P < 0.05$ vs. Zone.

|| $P < 0.05$ vs. Control.

not replicated in head-to-head RCTs, the most robust evidence available. Rather, head-to-head RCTs suggest that at 12 months, Atkins, WW, and Zone all achieved modest and similar weight loss. Moreover, 24-month data suggest that the modest weight losses achieved with Atkins or WW are partially regained over time. Moreover, there were more limited data on the long-term effects of the 4 popular diets on other cardiovascular risk factors, with Atkins and WW being the most studied. Overall, results from the 2 long-term head-to-head RCTs showed no marked differences among Atkins, WW, and Zone at improving cardiovascular risk factor levels. Although North Americans spend millions of dollars in the weight loss industry, available data are conflicting and insufficient to identify one popular diet as being more beneficial than the others.

The prevalence of overweight and obesity has risen steadily over the past few decades worldwide, with nearly 1.5 billion adults estimated to be overweight or obese as of 2008.²⁷ In the United States, the prevalence of overweight and obesity reaches 69.2% and 35.9%, respectively.²⁸ The health consequences of this trend are well-established and include increased prevalences of cardiovascular disease, metabolic syndrome, and type 2 diabetes mellitus.²⁹ Consequently, effective prevention and management strategies are needed to reduce the burdens of overweight, obesity, and their associated comorbidities.^{30,31} Despite their popularity,¹⁻⁴ the Atkins, SB, WW, and Zone diets seem to only achieve modest sustained weight loss. Comprehensive lifestyle interventions aimed at curbing both adult and childhood obesity are urgently needed. Interventions that include dietary, behavioral, and exercise components, as well as legislative measures and industry regulations, may be better suited to the multifaceted obesity epidemic.³²

Our results stem from the review of RCTs that predominantly enrolled young, white, obese women. Few data were available in other ethnic groups or in individuals who were overweight but not obese. The paucity of data available in men is also concerning. Pagoto et al.³³ previously highlighted this underrepresentation in their systematic review of RCTs investigating different lifestyle interventions for weight loss, where the average proportions of men and women were 27% versus 73%, respectively.³³ Thus, our findings regarding study populations in RCTs in this area are not an isolated occurrence.

The generalizability of the weight loss observed with these popular diets in RCTs to a real-world setting remains unclear. We found that 12-month mean weight loss with WW ranged from 3.0 to 6.0 kg.¹⁷⁻²² In a recent observational study of individuals prescribed a 12-month WW diet by health-care professionals through the UK's WW National Health Service Referral Scheme, median weight loss was 2.8 kg at 12 months.³⁴ Thus, the weight loss achieved in the ideal conditions of RCTs likely overestimates that achieved by patients seen as part of everyday clinical practice.

To our knowledge, our study is the first systematic review of RCTs to specifically focus on the Atkins, SB, WW, and Zone diets. A previous systematic review of major commercial weight loss programs in the United States examined the 3 major nonmedical weight loss programs at the time (WW, Jenny Craig, LA Weight loss), as well as medically supervised proprietary programs, online programs, and organized self-help programs, but excluded book-based diets.³⁵ This previous

review included case series in addition to RCTs. Similar to our findings, the authors concluded that: "With the exception of 1 trial of WW, the evidence to support the use of major commercial and self-help weight loss programs is suboptimal."³⁵

Limitations

First, our review focused on the Atkins, SB, Zone, and WW popular diets. To ensure this, only RCTs clearly referencing or mentioning the diet name were included, which could have resulted in fewer included studies. Moreover, other commercial diets are available that were not studied here; such diets deserve to be the object of additional studies. However, the 4 included diets constitute a representative sample of commercial North American popular diets. Second, some of the included RCTs were limited by relatively small sample sizes and may have been underpowered. Third, a key principle of RCTs is the use of intention-to-treat analysis in which all patients are included. Included studies had high attrition rates, and studies varied in their statistical approach to address this limitation, each of which rests on a given set of assumptions: completers' analysis assumes participants completing the trial are similar to those who do not, resulting in potential selection bias, whereas the last-observation-carried-forward method assumes that participants' subsequent outcomes are the same as the last one available, underestimating the data's true variability.³⁶ Although using missing data techniques such as multiple imputation can help reduce the bias because of incomplete follow-up, every effort must be made to ensure complete follow-up to ensure the validity of trials. Fourth, inclusion was restricted to published data. We reviewed a large number of RCTs during the conduct of our systematic review, and only a small number of the published RCTs were well-designed. Thus, the probability that there are well-designed RCTs that are unpublished is low, limiting the potential contribution of these unpublished data. Nonetheless, the presence of publication bias, a potential limitation of all systematic reviews, cannot be excluded. Finally, all included trials were open-label, a limitation inherent to trials examining dietary interventions.

Conclusions

Our study was designed to examine the evidence currently available from the literature to examine the efficacy of 4 commercial, popular diets on weight loss and improving cardiovascular risk factors, with a particular focus on sustained weight loss at ≥ 12 months. Our results suggest that all 4 diets are modestly efficacious at decreasing weight in the short-term, but that these benefits are not sustained long-term. RCTs comparing popular diets to usual care showed that only WW consistently demonstrated greater efficacy at reducing weight at 12 months. Head-to-head RCTs demonstrated that Atkins, WW, and Zone are all modestly and similarly efficacious at achieving sustained weight loss at ≥ 12 months. Finally, while North Americans spend millions of dollars in the weight loss industry, available data are conflicting and insufficient to identify one popular diet as being more beneficial than the others.

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Disclosures

None.

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SUPPLEMENTAL MATERIAL

1. Supplemental Tables

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2. Supplemental References

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Supplemental Table 1. Overview of the five popular diets

Diet	Duration of Treatment	Energy Intake	Protein		Carbohydrates		Fat		Low Carb	Low Fat	Alcohol Intake	Caffeine Intake
			%	Type of Protein	%	Type of Carbohydrate	%	Type of Fat				
Atkins ¹	<u>Phase 1:</u> 2 weeks. <u>Phase 2:</u> Ongoing weight loss <u>Phase 3:</u> Until target weight is maintained. <u>Phase 4:</u> Lifelong maintenance	Not specified	10	Not Specified	30	Strict Rules	60	Not specified	Yes	No	<u>Phase 1:</u> none <u>After:</u> in moderation (counted as a carbohydrate)	Avoid caffeine
Ornish ²	Indefinite	Not specified	20	Lean proteins	70	Whole grains, fruits, vegetables	10	Not specified	No	Yes	None	Avoid caffeine
South Beach ³	<u>Phase 1:</u> 2 weeks <u>Phase 2:</u> Until target weight is achieved. <u>Phase 3:</u> Lifelong maintenance	Not specified	30	Lean Proteins	20	<u>Phase 1:</u> very limited <u>Phase 2 and 3:</u> Moderate limitations on processed carbs	50	Poly- or mono-unsaturated	Yes	Yes	Wine is allowed (especially red wine). About a glass/day.	No restriction
Weight Watchers ⁴	Plan is until healthy weight is maintained. After: maintenance plan.	Points based on caloric content, fiber and fat content. Min: 1050 Max: 2350	20 - 25	Lean Proteins	45 - 55	Whole Grains, Fruits, Vegetables	20 - 35	Recommend 2 tablespoons of healthy oil (mono-unsaturated, vitamin E)	No	Yes	Based on point system. 1 cup/day for women. 2 cups/day for men.	No restriction
Zone ⁵	Indefinite	<u>Men:</u> 1400-1500 calories <u>Women:</u> 1100-1200 calories	30	Not specified	40	Low glycemic load	30	Plan approved fats: e.g. Almonds, olive oil, avocado.	Yes	Yes	Treated as a carbohydrate. 1 serving of alcohol = 10g of carbohydrates	Avoid caffeine

Supplemental Table 2. Baseline characteristics of participants in short-term (4 to 24 weeks) trials.

Study	Participants		Duration (Weeks)	Population	Arms	Nutritional Counseling	Exercise Prescription	Age (y)	Female (%)	Caucasian (%)	Weight (kg)	BMI (kg/m ²)		
	Randomized	Analyzed												
Atkins														
Rankin 2007 ⁶	32*	29*,†	4	BMI > 24.5, premenopausal, otherwise healthy	Atkins	HC/LP/LFD with CR	No	No	39.5*	100	87.5	83.3*	32.1	
Nickols-Richardson 2005 ⁷	28	28	6	BMI: 25-40, premenopausal, otherwise healthy	Atkins	NCEP HC/LFD with CR	Yes	No	39.5	100	NR	82.0	30.7	
Phillips 2008 ⁸	28	20†	6‡	BMI: 29-39, otherwise healthy	Atkins minus 750 calories for 4 weeks	AHA LFD minus 750 calories for 4 weeks	No	No	35.5†	75.0†	70.0†	97.8†	33.9†	
Hernandez 2010 ^{9§}	32	32	6	BMI: 30-40, otherwise healthy	Atkins with comprehensive behavioral program	HC/US Food Guide Pyramid LFD with CR	Yes	No	43.1	68.8	NR	102	NR	
Liu ¹⁰ 2013	50	49#	12	BMI ≥ 24**, aged 30-65	Atkins	Traditional Chinese diet design with CR††	No	No	47.9	100	0	65.9	26.7	
Brehm 2005 ¹¹	50	40†	16	BMI: 30-35, otherwise healthy	Atkins	AHA LFD with CR	Yes	No	43.0†	100	80.0	90.8†	33.2†	
Brehm 2003 ¹²	53	42†	24	BMI: 30-35, otherwise healthy	Atkins	AHA LFD with CR	Yes	No	43.7†	100	75.5	91.7†	33.6†	
Yancy 2004 ¹³	120	119#	24	BMI: 30-60, hyperlipidemic, generally healthy	Atkins + Daily Supplements	LFD with CR	Yes	Yes	44.9#	76.5#	76.5#	97.3#	34.3‡‡	
South Beach														
Aude 2004 ¹⁴	60	54†	12	BMI ≥ 27, otherwise healthy	South Beach with CR	NCEP diet with CR	Yes	No	45.1†	51.9†	NR	99.5†	35.2†	
Weight Watchers														
Rippe 1998 ¹⁵	80	44†	12	Overweight/obese, otherwise healthy§§	WW	Maintenance of current diet/exercise	No	No	36.8†	100	NR	81.5†	NR	
Johnston 2013 ¹⁶	292	257†	24	BMI: 27-40, aged ≥ 18	WW	Self-help	No	No	46.6	89.7	90.7	90.1	33.0	
Zone														
Landers 2002 ¹⁷	91##	33†, ##	12	BMI > 27, otherwise healthy	Zone	Hypocaloric diabetic exchange diet	Yes	No	NR	NR	NR	NR	NR	
Head-to-Head														
McAuley 2005 ^{18,}	96***	93†††	24	BMI > 27, insulin-resistant, otherwise healthy	Atkins	Zone	HC/high-fibre diet	No	Yes	45.6†††	100	100	95.8†††	35.7†††
Truby 2006, 2009 ^{19, 20, , †††}	176	176§§§	24	BMI: 27-40, otherwise healthy	Atkins	WW	Maintenance Of current diet/exercise	No	Yes	40.5	73.9	NR	89.0	31.5

AHA indicates American Heart Association; BMI, body mass index; CR, calorie restriction; HC, High-carbohydrate; LP, Low-protein; LFD, low-fat diet; NCEP, National Cholesterol Education Program; NR, not reported; WW, Weight Watchers.

* The number of participants in each arm of the study is not reported. Baseline characteristics were averaged across groups assuming an equal sample size in each treatment group. † Completers analysis. ‡ The dietary

intervention involved a 4-week weight loss phase and a 2-week weight maintenance phase. Except for fasting glucose and insulin outcomes reported at 4 and 6 weeks, all other outcomes of interest were reported at 2 and 6 weeks of follow-up, hence 6-week outcomes were included in our systematic review. § Substudy of Foster et. al.²¹ with independent measurements except for those assessing weight. || Delivered in-person to participants through group sessions held throughout the study follow-up, and comprising topics on behavioural skills (e.g., self-monitoring, stimulus control, relapse management); an exercise prescription; and daily multivitamin supplements. # Intention-to-treat analysis (ITT). ** Overweight for the Chinese people is defined as BMI ≥ 24 . †† Daily CR to 65% on average of usual intake, with calories from carbohydrates, protein and fat being 50-55%, 17-19% and 26-33%, respectively. ‡‡ Linear mixed-effects model analysis which assumes non-informative dropouts. §§ Study participants' weight exceeded the 1983 Metropolitan Life Insurance Table of desirable weight for height by 20 to 50%. ||| Trial had other arms that were not included. ## A total of 91 participants were randomized to 1 of 3 dietary interventions. The results presented are that of the 33 study completers in the Zone or usual care arms only. *** Of the 96 participants randomized, 3 withdrew before the start of their assigned diet intervention and were excluded from analyses. ††† ITT analysis, with mixed-models comprising a random effect for each participant and assuming an underlying variance-covariance structure. ‡‡‡ Lipid and glycemic control measures data for the Truby et al.¹⁹ trial were reported in a secondary paper by Morgan et al.²⁰ §§§ ITT analysis with baseline observation carried forward (BOCF).

Supplemental Table 3. Change in body weight and other anthropometric measures in short-term (4 to 24 weeks) trials.

Study	Follow-up (Weeks)	Weight				Body Mass Index			Waist Circumference			Body Fat		
		Baseline (kg)	Follow-Up (kg)	Mean Change (kg)	% Change	Baseline (kg/m ²)	Follow-Up (kg/m ²)	Mean Change (kg/m ²)	Baseline (cm)	Follow-Up (cm)	Mean Change (cm)	Baseline (kg or %)	Follow-Up (kg or %)	Mean Change (kg or %)
Atkins														
Rankin 2007 ⁶	4	79.2±16.0	76.6±15.7	-2.6±1.7	NR	31.4±5.4	NR	NR	NR	NR	NR	NR	NR	NR
Control		87.3±15.2	83.5±14.8	-3.8±1.2		32.7±5.5								
Nickols-Richardson 2005 ⁷	6	79.8±12.1	75.6±15.4	-4.2†	NR	30.3±5.5	29.0±5.3	-1.3†	NR	NR	NR	NR	NR	NR
Control		84.6±12.7	78.2±15.9	-6.4†, §		31.1±4.9	29.3±4.6	-1.8†						
Phillips 2008 ⁸	6	100.2 (SE: 3.7)	96.1 (SE: 4.0)	-4.0 (SE: 0.5)	NR	33.8 (SE: 1.1)	32.3 (SE: 1.2)	-1.5†	NR	NR	NR	NR	NR	NR
Control		95.4 (SE: 4.1)	89.9 (SE: 3.8)	-5.2 (SE: 0.6)		34.0 (SE: 0.9)	32.0 (SE: 0.8)	-2.0†						
Hernandez 2010 ⁹	6	103±11	95.4±11.3	-6.0±3.5	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Control		101±13	97.3±12.9	-6.2±4.8		NR	NR	NR						NR
Liu 2013 ¹⁰	12	67.0 (SE: 1.3)	61.2 (SE: 1.1)	-5.1 (-5.5, -4.7)	NR	26.9 (SE: 0.4)	24.5 (SE: 0.4)	-2.1 (-2.2, -1.9)	91.0 (SE: 1.1)	84.2 (SE: 1.3)	-6.5 (-8.3, -4.7)	23.1 (SE: 0.8) kg	20.1 (SE: 0.7) kg	-2.59 (-3.02, -2.15) kg
Control		64.8 (SE: 1.3)	59.5 (SE: 1.2)	-5.3 (-6.1, -4.5)		26.6 (SE: 0.5)	24.4 (SE: 0.4)	-2.2 (-2.6, -1.8)	90.2 (SE: 1.1)	82.4 (SE: 1.4)	-7.9 (-9.2, -6.5)	22.6 (SE: 0.8) kg	20.1 (SE: 0.8) kg	-2.48 (-3.10, -1.85) kg
Brehm 2005 ¹¹	16	90.9 (SE: 2.1)	NR	-6.14 (SE: 0.91)	NR	33.5 (SE: 0.5)	NR	NR	NR	NR	NR	37.15 (SE: 0.92) kg	33.91 (SE: 1.29) kg	-3.2 (SE: 0.67) kg
Control		90.6 (SE: 2.4)		-9.79 (SE : 0.71)§		32.8 (SE: 0.5)						37.89 (SE: 1.27) kg	31.70 (SE: 1.41) kg	-6.2 (SE: 0.67)§ kg
Brehm 2003 ¹²	24	92.31±6.0	NR	-3.9 (SE: 1.0)	NR	34.04±1.83	NR	NR	NR	NR	NR	37.83±2.65 kg	35.85±4.13 kg	-2.0 (SE: 0.75) kg
Control		91.2±8.4		-8.5 (SE: 1.0)§		33.17±1.83						37.33±4.79 kg	32.55±5.17 kg	-4.8 (SE: 0.67)§ kg
Yancy 2004 ¹³	24	96.8±19.2	NR	-6.5 (-8.4, -4.6)	-6.7 (-8.7, -4.8)	34.0±5.2	NR	NR	NR	NR	NR	41.1±NR %	38.3±NR %	-2.8 (-3.9, -1.9) %
Control		97.8±15.0		-12.0§ (-13.8, -10.2)	-12.9§ (-14.8, -10.9)	34.6±4.9						41.0±NR %	35.2±NR %	-5.8§ (-6.7, -4.8) %
South Beach														
Aude 2004 ¹⁴	12	99.9±21.1	NR	-3.4±2.0	NR	35.5±6.0	NR	NR	NR	NR	NR	NR	NR	NR
Control		99.1±31.9		-6.2±1.8§		34.9±4.0								
Weight Watchers														
Rippe 1998 ¹⁵	12	82.1±5.3	NR	1.3±1.3	NR	NR	NR	NR	NR	NR	NR	36.2±2.7%	36.0±NR %	-0.2†
Control		81.2±7.6		-6.1±4.0§		36.8±2.6 %						32.5±NR %	-4.8†, §	
Johnston 2013 ¹⁶	24	90.0±12.7	NR	-0.6±NR	NR	32.8±3.6	NR	NR	NR	NR	NR	NR	NR	NR
Control		90.2±14.1		-4.6±NR§		33.1±3.7								
Zone														
Landers 2002 ^{17*}	12	NR	NR	-5.4±2.8	NR	NR	NR	NR	NR	NR	NR	NR	NR	-3.52±2.62 kg
Control		-4.4±3.2												
Head-to-Head														
McAuley 2005 ^{18*, †, ‡}	8	98.0±15.1	93.7±14.6	-4.3†	NR	36.6±5.6	35.2±5.6	-1.4†	109.1±11.6	104.3±10.9	-4.8†	46.1±9.9 kg	42.7±9.7 kg	-3.4†
Control		96.0±10.8	89.4±10.3	-6.6†, §		36.0±3.9	33.5±3.7	-2.5†, §	108.9±9.9	100.6±9.6	-8.3†, §	44.2±6.9 kg	39.8±7.1 kg	-4.4†, §
Atkins		93.2±14.5	87.8±13.7	-5.4†, §		34.5±5.3	32.4±4.8	-2.1†, §	108.0±11.5	100.3±9.6	-7.7†, §	42.1±8.0 kg	39.0±7.8 kg	-3.1†, §
Truby 2006, 2009 ^{19, 20*, †}	24	87.9±13.5	NR	0.6±2.2	0.6±2.7	31.5±2.9	NR	NR	100±10.1	NR	-0.8±3.8	33.4±6.5 kg	NR	0.3±4.4 kg
Control		90.3±12.7		-6.0±6.4	-6.2±6.2	31.9±2.2			102±10.6		-8.1±7.4	35.7±6.0 kg		-4.6±4.8 kg
Atkins		88.8±13.3		-6.6±5.4	-7.3±6.1	31.2±2.7			100±10.3		-8.3±7.0	34.2±6.9 kg		-5.0±4.3 kg

All values are mean±SD or mean (95% CI) unless otherwise indicated. NR indicates not reported; SE, standard error; WW, Weight Watchers.

* Trial had other arms that were not included. † Calculated from data in the publication. ‡ Data at the end of the 8-week intervention period, not including weight maintenance period (the study's maximum duration of follow-up is 24 weeks). § $p < 0.05$ vs. Control.

Supplemental Table 4. Change in lipid levels in short-term (4 to 24 weeks) trials.

Study	Follow-up (Weeks)	Total Cholesterol			Low-Density Lipoprotein Cholesterol			High-Density Lipoprotein Cholesterol			Triglycerides		
		Baseline TC (mmol/L)	TC at Follow-Up (mmol/L)	TC Mean Change (mmol/L)	Baseline (mmol/L)	Follow-Up (mmol/L)	Mean Change (mmol/L)	Baseline (mmol/L)	Follow-Up (mmol/L)	Mean Change (mmol/L)	Baseline (mmol/L)	Follow-Up (mmol/L)	Mean Change (mmol/L)
Atkins													
Rankin 2007 ⁶													
Control	4	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Intervention													
Nickols-Richardson 2005 ⁷													
Control	6	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Intervention													
Phillips 2008 ⁸													
Control	6	3.95 (SE: 0.22)	3.76 (SE: 0.22)	-0.19‡	2.43 (SE: 0.18)	2.18 (SE: 0.24)	-0.25‡	1.29 (SE: 0.11)	1.15 (SE: 0.12)	-0.14‡	0.68 (SE: 0.08)	0.78 (SE: 0.27)	0.10‡
Intervention		4.08 (SE: 0.11)	4.22 (SE: 0.16)	0.14‡	2.13 (SE: 0.37)	2.47 (SE: 0.35)	0.34‡	1.41 (SE: 0.14)	1.41 (SE: 0.13)	0.0‡	0.88 (SE: 0.16)	0.65 (SE: 0.05)	-0.23‡
Hernandez 2010 ⁹													
Control	6	NR	NR	NR	2.6† (IQR: 2.4, 3.0)	2.4† (IQR: 2.2, 2.9)	-0.2±0.2	1.2† (IQR: 1.1, 1.5)	1.1† (IQR: 1.0, 1.2)	-0.1±0.2	1.3±0.62	1.02±0.55	-0.3±0.5
Intervention					2.8† (IQR: 2.0, 3.3)	3.1† (IQR: 2.5, 3.4)	0.3±0.7#	1.1† (IQR: 0.9, 1.6)	1.1† (IQR: 0.9, 1.5)	0.0±0.3	1.4±0.66	0.91±0.33	-0.5±0.7
Liu 2013 ¹⁰													
Control	12	5.19 (SE: 0.24)	4.55 (SE: 0.16)	-0.68 (-1.11, -0.26)	3.44 (SE: 0.20)	2.99 (SE: 0.13)	-0.5 (-0.84, -0.17)	1.44 (SE: 0.08)	1.31 (SE: 0.07)	-0.14 (-0.27, -0.00)	1.33 (SE: 0.12)	0.90 (SE: 0.11)	-0.45 (-0.57, -0.33)
Intervention		5.01 (SE: 0.21)	5.00 (SE: 0.25)	0.01 (-0.61, 0.62)	3.30 (SE: 0.16)	3.35 (SE: 0.23)	0.05 (-0.40, 0.50)	1.30 (SE: 0.07)	1.45 (SE: 0.07)	0.16 (-0.02, 0.34)#	1.69 (SE: 0.26)	0.79 (SE: 0.07)	-0.88 (-1.37, -0.41)
Brehm 2005 ¹¹													
Control	16	5.08 (SE: 0.21)	4.89 (SE: 0.25)	-0.19‡	3.24 (SE: 0.15)	3.02 (SE: 0.21)	-0.22‡	1.15 (SE: 0.04)	1.2 (SE: 0.05)	0.05‡	1.65 (SE: 0.23)	1.48 (SE: 0.15)	-0.17‡
Intervention		5.31 (SE: 0.25)	5.17 (SE: 0.27)	-0.14‡	3.49 (SE: 0.21)	3.42 (SE: 0.26)	-0.07‡	1.15 (SE: 0.05)	1.34 (SE: 0.07)	0.19‡, #	1.46 (SE: 0.15)	0.91 (SE: 0.07)	-0.55‡
Brehm 2003 ¹²													
Control	24	4.78 (SE: 0.16)	4.74 (SE: 0.16)	-0.04‡	2.95 (SE: 0.16)	2.79 (SE: 0.15)	-0.16‡	1.26 (SE: 0.06)	1.37 (SE: 0.07)	0.11‡	1.23 (SE: 0.11)	1.25 (SE: 0.14)	0.02‡
Intervention		5.34 (SE: 0.17)	5.32 (SE: 0.18)	-0.02‡	3.23 (SE: 0.14)	3.21 (SE: 0.15)	-0.02‡	1.34 (SE: 0.07)	1.52 (SE: 0.07)	0.16‡	1.68 (SE: 0.15)	1.29 (SE: 0.17)	-0.39‡
Yancy 2004 ¹³													
Control	24	6.20±NR	5.85±NR	-0.35 (NR)	3.83±NR	3.64±NR	-0.19 (NR)	1.40±NR	1.36±NR	-0.04 (NR)	2.15±NR	1.84±NR	-0.3 (NR)
Intervention		6.32±NR	6.11±NR	-0.21 (NR)	4.07±NR	4.11±NR	0.04 (NR)	1.43±NR	1.57±NR	0.14 (NR)#	1.78±NR	0.94±NR	-0.8 (NR)#
South Beach													
Aude 2004 ¹⁴													
Control	12	5.33±0.95		-0.3±0.5	3.17±0.69		-0.2±0.4	1.41±0.48		-0.1±0.2	1.64±0.899		-0.2±0.5
Intervention		5.51±1.2	NR	-0.3±0.8	3.32±1.16	NR	-0.1±0.7	1.3±0.37	NR	-0.0±0.2	2.05±1.51	NR	-0.5±1.1
Weight Watchers													
Rippe 1998 ¹⁵													
Control	12	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Intervention													
Johnston 2013 ¹⁶													
Control	24	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Intervention													
Zone													
Landers 2002 ^{17*}													
Control	12												
Intervention	12	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Head-to-Head													
McAuley 2005 ^{18*,§}													
Control	8	5.9±0.9	5.3±0.9	-0.6‡	3.9±0.8	3.6±0.9	-0.3‡	1.16±0.21	1.09±0.25	-0.07‡	1.77±0.57	1.46±0.51	-0.31‡
Atkins	8	5.8±1.0	5.5±1.2	-0.3‡, ††	3.8±0.9	3.8±1.0	0.0‡	1.17±0.28	1.18±0.29	0.01‡, #	1.78±0.76	1.09±0.25	-0.69‡, #
Zone	8	5.7±1.0	5.0±0.8	-0.7‡	3.7±0.8	3.3±0.7	-0.4‡, **	1.21±0.23	1.16±0.24	-0.05‡	1.86±0.66	1.23±0.43	-0.63‡, #
Truby 2006, 2009 ^{19, 20*}													
Control	24	5.80±1.1	NR	-0.5±0.2	3.64±0.84	3.55±0.73	-0.09‡	1.19±0.22	1.04±0.20	-0.15‡	1.40±0.65	1.38±0.65	-0.02‡
Atkins	24	5.77±0.9	NR	-0.3±0.8	3.72±0.52	3.56±0.76	-0.16‡	1.22±0.23	1.14±0.32	-0.08‡	1.65±0.70	1.01±0.33	-0.64‡
Weight Watchers	24	5.58±1.1	NR	-0.6±0.7#	3.56±0.81	3.13±0.58	-0.43‡	1.16±0.24	0.98±0.15	-0.18‡	1.55±0.77	1.20±0.47	-0.35‡

All values are mean±SD or mean (95% CI) unless otherwise indicated. IQR indicates interquartile range; NR, not reported; SE, standard error.

* Trial had other arms that were not included. † Median (IQR). ‡ Calculated from data in the publication. § Data at the end of the 8-week intervention period, not including weight maintenance period (the study's maximum duration of follow-up is 24 weeks). || Lipid data for the Truby et al. trial were reported in a secondary paper by Morgan et al.²⁰ # p<0.05 vs. Control. ** p<0.05 vs. Atkins. †† p<0.05 vs. Zone.

Supplemental Table 5. Change in blood pressure in short-term (4 to 24 weeks) trials.

Study	Follow-up (Weeks)	Systolic Blood Pressure				Diastolic Blood Pressure			
		Baseline (mm Hg)	Follow-Up (mm Hg)	Mean Change (mm Hg)	% Change	Baseline (mm Hg)	Follow-Up (mm Hg)	Mean Change (mm Hg)	% Change
Atkins									
Rankin 2007 ⁶									
Control	4	NR	NR	NR	NR	NR	NR	NR	NR
Intervention									
Nickols-Richardson 2005 ⁷									
Control	6	NR	NR	NR	NR	NR	NR	NR	NR
Intervention									
Phillips 2008 ⁸									
Control	6	124.1 (SE: 4.0)	115.2 (SE: 3.0)	-8.9†	NR	73.2 (SE: 3.6)	66.8 (SE: 3.3)	-6.4†	NR
Intervention		123.3 (SE: 3.1)	112.6 (SE: 2.7)	-10.7†		70.0 (SE: 3.5)	65.8 (SE: 2.6)	-4.2†	
Hernandez 2010 ⁹									
Control	6	NR	NR	NR	NR	NR	NR	NR	NR
Intervention									
Liu 2013 ¹⁰									
Control	12	131.4 (SE: 3.4)	116.4 (SE: 2.6)	-15.7 (-20.4, -11.0)	NR	85.5 (SE: 2.0)	77.7 (SE: 2.0)	-8.1 (-11.3, -4.8)	NR
Intervention		134.0 (SE: 3.4)	113.7 (SE: 2.0)	-20.3 (-24.8, -15.8)		86.5 (SE: 1.6)	75.7 (SE: 1.5)	-10.8 (-13.0, -8.7)	
Brehm 2005 ¹¹									
Control	16	119 (SE: 2.9)	116 (SE: 3.5)	-3†	NR	77 (SE: 1.7)	75 (SE: 2.8)	-2†	NR
Intervention		119 (SE: 3.5)	110 (SE: 3.4)	-9†		76 (SE: 1.7)	71 (SE: 2.1)	-5†	
Brehm 2003 ¹²									
Control	24	115 (SE: 2.47)	113 (SE: 2.41)	-2†	NR	75 (SE: 1.99)	74 (SE: 1.62)	-1†	NR
Intervention		116 (SE: 3.23)	114 (SE: 2.82)	-2†		79 (SE: 2.69)	74 (SE: 2.23)	-5†	
Yancy 2004 ¹³									
Control	24	NR	NR	-7.5 (-11.6, -3.5)	NR	NR	NR	-5.2 (-7.5, -2.9)	NR
Intervention		NR	NR	-9.6 (-13.3, -6.0)	NR	NR	NR	-6.0 (-8.0, -3.9)	
South Beach									
Aude 2004 ¹⁴									
Control	12	NR	NR	NR	NR	NR	NR	NR	NR
Intervention									
Weight Watchers									
Rippe 1998 ¹⁵									
Control	12	117.4±8.8	114.5±9.6	-3.2±11.8	NR	81.1±6.5	79.0±6.7	-2.1±7.9	NR
Intervention		117.2±13.8	110.7±13.1	-6.5±13.1		81.0±7.0	76.7±8.8	-4.3±9.6§	
Johnston 2013 ¹⁶									
Control	24	NR	NR	NR	NR	NR	NR	NR	NR
Intervention									
Zone									
Landers 2002 ^{17*}									
Control	12	NR	NR	NR	NR	NR	NR	NR	NR
Intervention									
Head-to-Head									
McAuley 2005 ^{18§,*,‡}									
Control	8	126±11	122±13	-4†	NR	81±10	80±9	-1†	NR
Atkins*		130±14	118±14	-12†		83±10	76±10	-7†	
Zone*		124±13	122±14	-2†		80±9	76±7	-4†	
Truby 2006, 2009 ^{19, 20*}									
Control	24	130±16.1	NR	-2.8±11.8	NR	81±9.6	NR	-1.6±7.4	NR
Atkins		135±15.1		-7.2±11.6		83±10.7		-4.9±8.1	
Weight Watchers		127±15.1		-4.1±11.7		80±10.7		-4.4±8.6	

All values are mean±SD or mean (95% CI) unless otherwise indicated. NR indicates not reported; SE, standard error.

* Trial had other arms that were not included. † Calculated from data in the publication. ‡ Data at the end of the 8-week intervention period, not including weight maintenance period (the study's maximum duration of follow-up is 24 weeks). § p<0.05 vs. Control.

Supplemental Table 6. Change in glycemic control outcomes in short-term (4 to 24 weeks) trials.

Study	Follow-up (Weeks)	Fasting Glucose			Fasting Insulin		
		Baseline (mmol/L)	Follow-Up (mmol/L)	Mean Change (mmol/L)	Baseline (pmol/L)	Follow-Up (pmol/L)	Mean Change (pmol/L)
Atkins							
Rankin 2007 ⁶							
Control	4	4.71±0.59	4.63±0.26	-0.08†	NR	NR	NR
Intervention		4.76±0.31	4.53±0.42	-0.23†			
Nickols-Richardson 2005 ⁷							
Control	6	NR	NR	NR	NR	NR	NR
Intervention							
Phillips 2008 ^{8*,†}							
Control	6	4.99 (SE: 0.11)	5.07 (SE: 0.09)	0.08†	118.4#	100.4#	-18†
Intervention		5.09 (SE: 0.06)	5.33 (SE: 0.12)	0.24†	126.4#	87.5#	-38.9†
Hernandez 2010 ⁹							
Control	6	4.76±0.46	4.75±0.36	-0.0±0.3	74.3±42.4	54.87±39.59	-19.5±36.8
Intervention		4.75±0.61	4.8±0.42	0.1±0.6	78.48±50.7	45.84±25	-32.6±55.6
Liu 2013 ¹⁰							
Control	12	6.15 (SE: 0.24)	5.86 (SE: 0.19)	-0.32 (-0.83, 0.20)	NR	NR	NR
Intervention		6.01 (SE: 0.18)	6.11 (SE: 0.24)	0.12 (-0.52, 0.76)			
Brehm 2005 ¹¹							
Control	16	5 (SE: 0.01)	NR	NR	151 (SE: 22)	133 (SE: 18)	-18†
Intervention					135 (SE: 12)	86 (SE: 10)	-49†
Brehm 2003 ¹²							
Control	24	5.06 (SE: 0.12)	4.86 (SE: 0.11)	NR	166 (SE: 16.25)	125.7 (SE: 14.6)	-40.3†
Intervention		5.5 (SE: 0.14)	5.00 (SE: 0.12)		117.37 (SE: 12.50)	100 (SE: 9.72)	-17.37†
Yancy 2004 ¹³							
Control	24	NR	NR	NR	NR	NR	NR
Intervention							
South Beach							
Aude 2004 ¹⁴							
Control	12	NR	NR	NR	NR	NR	NR
Intervention							
Weight Watchers							
Rippe 1998 ¹⁵							
Control	12	NR	NR	NR	NR	NR	NR
Intervention							
Johnston 2013 ¹⁶							
Control	24	NR	NR	NR	NR	NR	NR
Intervention							
Zone							
Landers 2002 ^{17*}							
Control	12	NR	NR	NR	NR	NR	NR
Intervention							
Head-to-Head							
McAuley 2005 ^{18*,‡}							
Control	8	5.0±0.6	4.8±0.4	-0.2†	102.79§ (84.7, 123.6)	73.6§ (52.8, 77.1)	-29.2†
Atkins		5.1±0.6	4.8±0.4	-0.3†	104.18§ (84.7, 127.8)	60.4§ (7.4,10.2)	-43.8†
Zone		5.1±0.5	5.0±0.6	-0.1†	82.65§ (70.84, 95.8)	46.5§ (39.58, 54.2)	-36.2†
Truby 2006, 2009 ^{19, 20*}							
Control	24	5.48±0.5	NR	-0.1±0.5	68.1±35.6	75.9±45.0	7.8†
Atkins		5.47±0.5		-0.2±0.5	73.2±35.1	54.8±32.4	-18.4†
Weight Watchers		5.46±0.5		-0.5±0.6**	62.2±32.4	52.9±30.2	-9.3†

All values are mean±SD or mean (95% CI) unless otherwise indicated. NR indicates not reported; SE, standard error.

* Trial had other arms that were not included. † Calculated from data in the publication. ‡ Data at the end of the 8-week intervention period, not including weight maintenance period (the study's maximum duration of follow-up is 24 weeks). § Geometric mean. || Glycemic control measures data for the Truby et al. trial were reported in a secondary paper by Morgan et al.²⁰ # Values reported in mg/dL in the publication are: Baseline: Atkins: 18.2 (SE: 3), Control: 17.05 (SE: 3.92); 6 weeks: Atkins: 12.6 (SE: 1.2), Control: 14.46 (SE: 2.09). ** p<0.05 vs. Control.

Supplemental Table 7. Change in glycemic control in long-term (≥ 12 months) trials.*

Study	Follow-up (Months)	Fasting Glucose		Fasting Insulin	
		Baseline (mmol/L)	Mean Change (mmol/L)	Baseline (pmol/L)	Mean Change (pmol/L)
Atkins					
Foster 2003 ²²					
Control	12	NR	NR	NR	NR
Intervention					
Davis 2009 ²³					
Control	12	NR	NR	NR	NR
Intervention					
Goldstein 2011 ²⁴					
Control	12	10.4±1.9	2.1±1.3	NR	NR
Intervention		10.5±2.6	1.8±0.9		
Shai 2008 ^{25‡}					
Control	12	2.3±0.7	NR	92.4±47.2	NR
Intervention		5.1±1.6		97.9±70.8	
Control	24	2.3±0.7		92.4±47.2	
Intervention		5.1±1.6		97.9±70.8	
Foster 2010 ²¹					
Control	12	NR	NR	NR	NR
Intervention					
Control	24				
Intervention					
South Beach					
Swenson 2007 ²⁶					
Control	12	NR	NR	NR	NR
Intervention					
Weight Watchers					
Marinilli Pinto 2013 ²⁷					
Control	12	NR	NR	NR	NR
Intervention					
Jebb 2011 ²⁸					
Control	12	NR	0.01 (SE: 0.03)	NR	-0.65 (SE: 0.95)
Intervention			-0.06 (SE: 0.02)†		-3.89 (SE: 0.97)†
Jolly 2011 ^{29‡}					
Control	12	NR	NR	NR	NR
Intervention					
Heshka 2003 ³⁰					
Control	12	4.94±0.67	0.20 (SE: 0.03)	125.01±69.45	-2.1 (SE: 3.5)
Intervention		5.11±0.78	0.19 (SE: 0.03)	125.01±62.51	-13.9 (SE: 3.5)†
Control	24	4.94±0.67	0.3 (SE: 0.04)	125.01±69.45	16.0 (SE: 4.2)
Intervention		5.11±0.78	0.3 (SE: 0.04)	125.01±62.51	4.2 (SE: 4.2)†
Head-to-Head					
Dansinger 2005 ^{31‡}					
Atkins	12	7.06±3.44	0.1±1.7	152.8±111.1	-8.3±46.5
Weight Watchers		6.44±2.94	-0.3±1.1	138.9±69.45	-18.1±42.4
Zone		6.44±2.67	-0.2±1.0	215.3±256.97	-37.5±97.2
Gardner 2007 ^{32‡}					
Control	12	5.3±0.9	0.0±0.5	69.45±55.6	-12.5±35.4
Atkins		5.1±0.5	-0.1±0.7	69.45±48.62	-12.5±33.3
Zone		5.2±1.1	-0.1±0.4	69.45±48.62	-10.4±34.0

All values are mean \pm SD or mean (95% CI) unless otherwise indicated. NR indicates not reported; SE, standard error.

* Only long-term follow-up data from these studies are presented in this table. † p<0.05 for difference between groups. ‡ Trial had other arms that were not included.

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